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WO 97/28830 A1 US 5810265 A US 5503335 A

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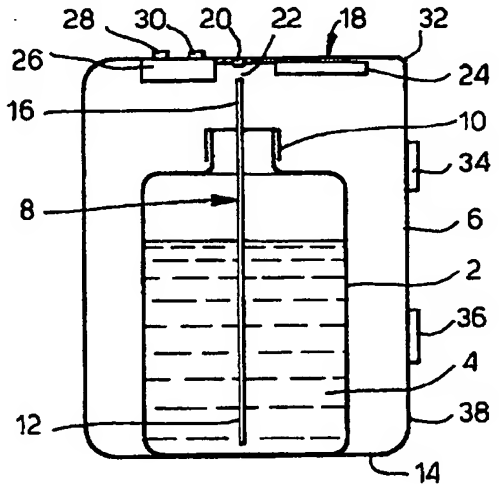
(54) Abstract Title
A vapour release device

(57) A vapour release device comprises a store of liquid 2 to be evaporated, and a capillary feed element 8 having a cross-sectional area not exceeding 10mm^2. The capillary feed element delivers liquid to a distal end region 16 outside the store, and the device also comprises means to accelerate the delivery of liquid, eg a point source heater 20 powered by an electric battery 24. The point source heater may be controlled by control means 26, eg an Application Specific Integrated Circuit (ASIC), including a timer. Adhesive pads 34, 36 may be provided on a rear wall 38 of a housing 6 of the device, to facilitate securement to a desired surface. The device may include a plurality of liquid stores, with a capillary element associated with each. The vapour released by the device may be a fragrance, a deodorizer, an insect repellant, an insecticide, a miticide, a sanitizer, a respiratory aid, or a natural oil.

Fig.1.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

Fig.1.

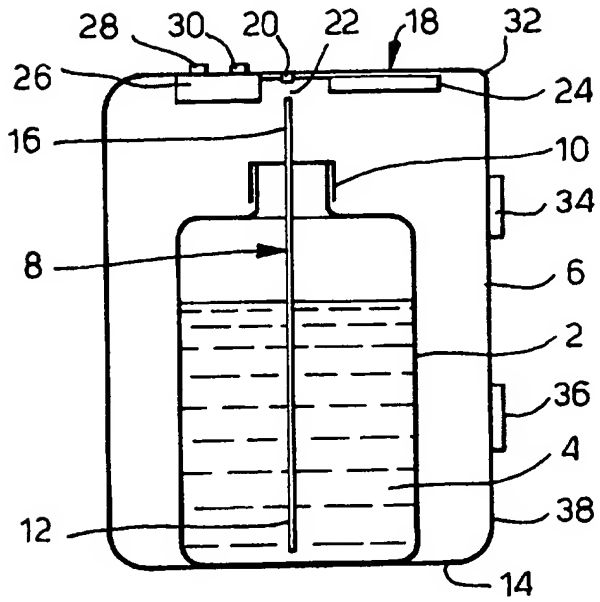


Fig.2.

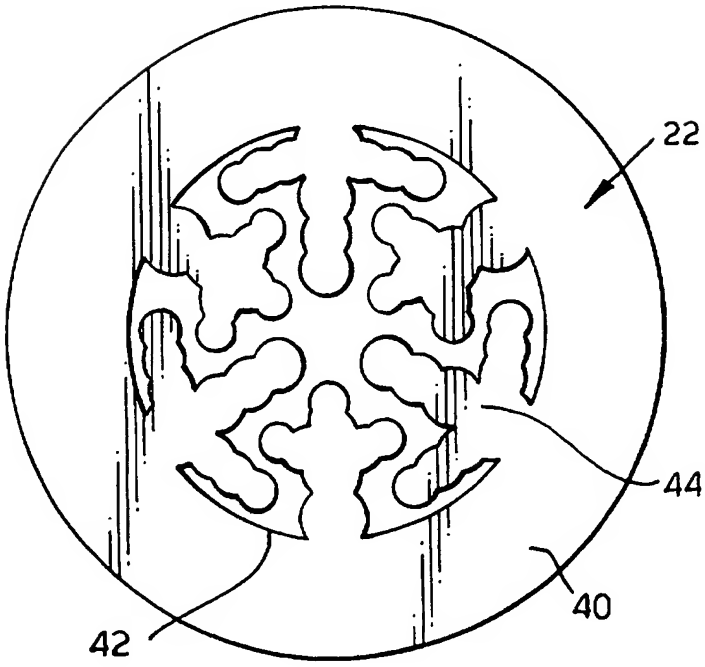


Fig.3.

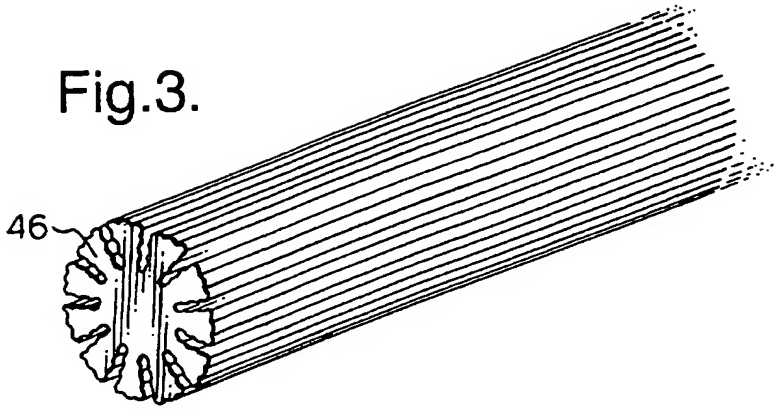


Fig.4.

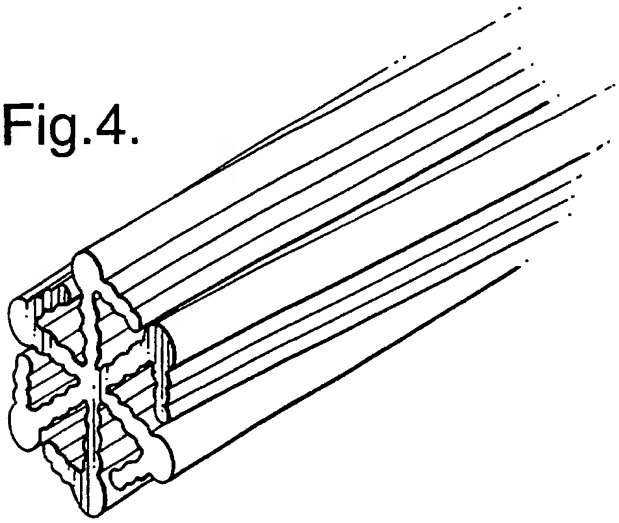


Fig.5.

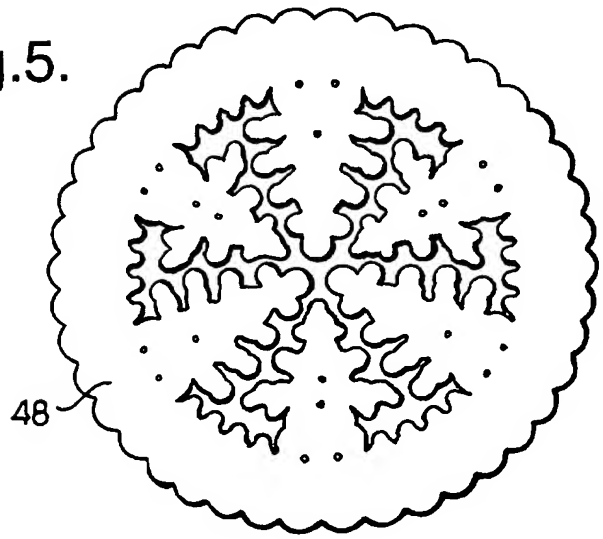


Fig.6.

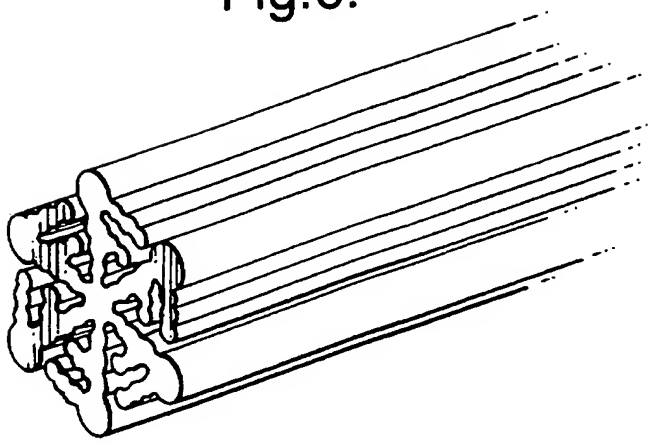


Fig.7.

Fig.8.

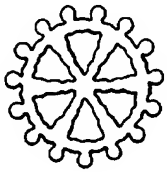


Fig.9.

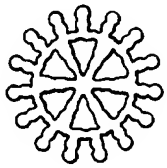


Fig.10.

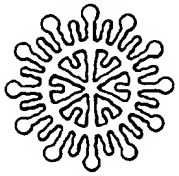


Fig.11.

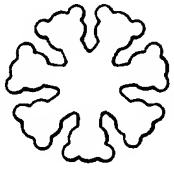


Fig.12.

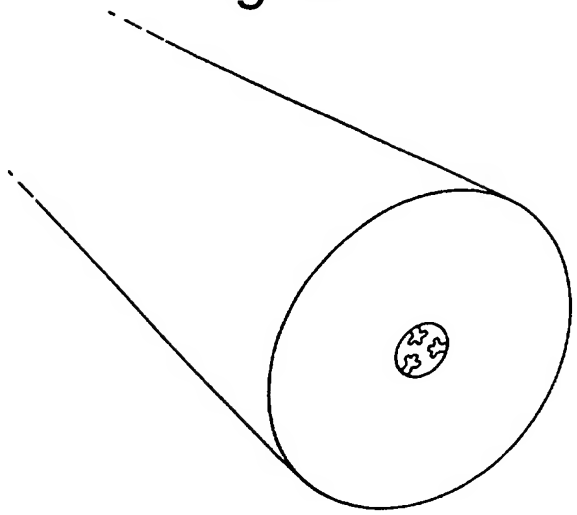
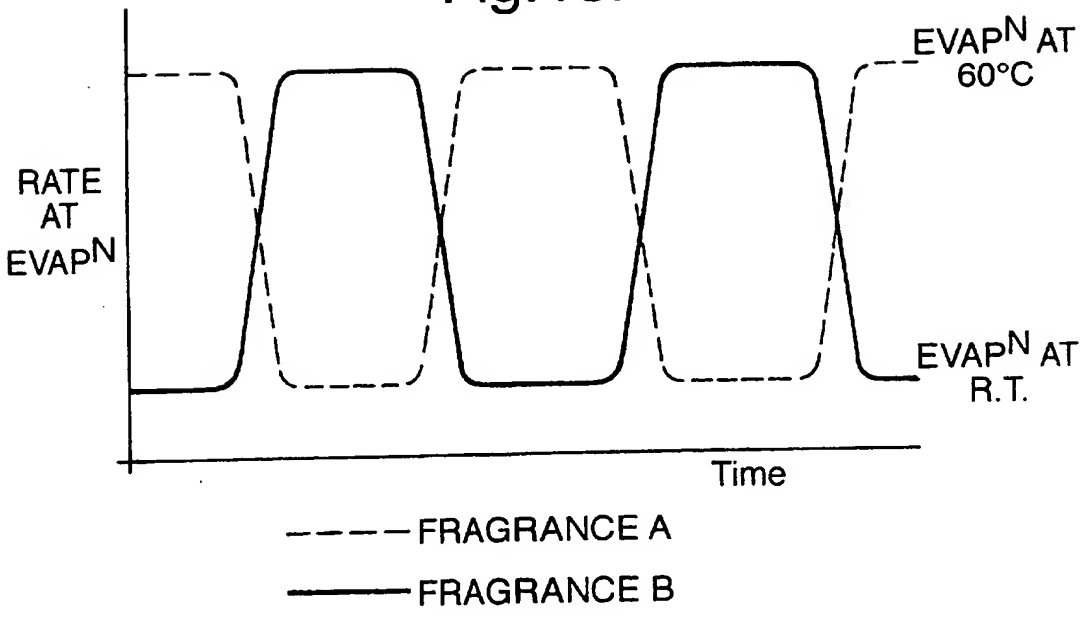


Fig.13.


RATE AT EVAP^N
EVAP^N AT 60°C
EVAP^N AT R.T.
Time
FRAGRANCE A
FRAGRANCE B

DEVICE

This invention relates to a vapour-release device able to evaporate a liquid into an air space, for example a room, the vapour thus evaporated having a desired characteristic. For example the vapour may comprise a fragrance, a deodoriser, an insect repellant, an insecticide, a miticide, a sanitiser or a respiratory aid, for example menthol. It may be a natural oil, for example citronella oil or eucalyptus oil.

Vapour-release devices are known, comprising a store of liquid to be evaporated, a wick in the form of a compressed wad of fibres and a heat source for evaporating the liquid drawn into the wick. Devices available on the market are plugged into the mains electricity socket, to obtain the power to operate the heater. The wicks are substantial cylindrical bodies several millimetres in diameter. The heat source is generally arranged to heat the distal end region of the wick, particularly the cylindrical surface adjacent to the distal end face. The evaporation rate tends to be rather high. If a concentrated liquid, for example a concentrated fragrance, is used the fragrancing effect can be overpowering. Therefore, it may be necessary to employ a large container, of a less concentrated liquid. Accordingly the devices can be somewhat bulky. Furthermore, the devices can only be used in certain areas of a building, where electricity sockets are available. They cannot be used in most bathrooms and toilets and cannot be used in central areas of most rooms. A further disadvantage is that vapour release from such devices is usually continuous, when the power supply is on. This can mean that vapour is released at times when it is not needed. Secondly, this continuous vapour release means that the perception of a fragrance is reduced by the well-known process of nasal adaptation. This means that it may become less noticeable to the person in the room to which fragrance is being delivered. Indeed that person may, after a period, no longer perceive it at all.

It is an object of embodiments of the present invention to provide a vapour-releasing device which provides a more efficient evaporation of liquid and/or which is compact

and/or which can be used in any place in which it is desired and/or which is adapted for intermittent vapour release.

In accordance with the present invention there is provided a vapour-release device comprising a store of liquid to be evaporated, the store being associated with a capillary feed device having a proximal end region within the store and a distal end region outside the store, the capillary feed device being of minimum cross-sectional area not exceeding $10mm^2$ and being adapted to deliver liquid from the store to the distal end region, and the device comprising means to accelerate the delivery of liquid by the capillary feed device.

Suitably the capillary feed device has one or more linear capillary pathways.

Preferably the or each linear capillary pathway extends longitudinally along the capillary feed device (in other words, parallel to the axis of the capillary feed device). Preferably such a capillary feed device has an identical cross sectional shape, internally and externally, all along its length (a fibrous body does not have the same internal cross section all along its length, having regard to fibre or filament ends). Preferably, the or each linear capillary pathway has a cross-section of identical shape and size throughout its length.

However the cross-sectional area could in principle vary. When we refer to minimum cross-sectional area we refer to the smallest cross-section presented between the proximal and distal ends of a capillary feed device of variable cross section.

Suitably the capillary feed device having one or more linear capillary pathways is a longitudinally formed body. Preferably it is body formed by extrusion (including a body made of severe parallel extrusions coalesced together). Preferably it is formed of plastics material.

The capillary feed device may have one or more linear capillary pathway(s), for example longitudinal grooves or striations, formed at its external surface. For example, the external surface may be generally cylindrical, suitably circularly cylindrical, but superimposed on the cylindrical surface may be longitudinal grooves or striations. In another embodiment the capillary feed device may be polygonal in cross section, with each polygonal face and/or the longitudinal edges having longitudinal grooves or striations. When we refer to cross-sectional area herein we mean to include the area of such external grooves or striations. In practical terms the cross-sectional area of an externally indented capillary feed device may, for the purpose of this specification, be regarded as the area bounded by a length of filament wrapped around the capillary feed device.

Alternatively the capillary feed device may have one or more internal linear capillary pathway(s).

Alternatively the capillary feed device may have one or more linear capillary pathway(s) formed at its external surface and one or more internal capillary pathway(s).

A preferred capillary feed device has one or more internal linear capillary pathway(s).

In other embodiments the capillary feed device may be of consolidated fibre form, for example of consolidated cellulose or plastics fibres. The fibres may be bonded together for rigidity. Suitable as a capillary feed device may, for example, be a fibrous body of the type used as an ink feeder and writing tip in "felt-tip" pens.

Preferably, the capillary feed device is of a material which is relatively rigid, and self-supporting when it is formed into a long thin body. By "relatively rigid" we can state the following. If one considers a capillary feed device held horizontally, with the distal end region projecting from the fingers, we consider it to be "relatively

rigid" if it stays straight under its own weight, and does not bow or droop downwards more than 1cm, when it projects 3cm beyond the fingers. A preferred capillary feed device does not bow or droop downwards more than 1cm when thus projected 5cm, more preferably 10cm, beyond the fingers, when thus held.

Suitable materials for a capillary feed device include polyacetals (especially polyoxyethylene) and polypropylene, in the case of a longitudinally formed capillary feed devices; and cellulose and polyester, in the case of a fibrous capillary feed device.

Preferably the minimum cross-sectional area of the capillary feed device is at least about 0.1mm^2, more preferably at least about 0.18mm^2, and most preferably at least about 0.25mm^2.

Preferably the minimum cross-sectional area of the capillary feed device is not greater than about 8mm^2, more preferably not greater than about 5mm^2, most preferably not greater than about 4mm^2. In the case of longitudinally formed capillary feed devices the cross-sectional area may be not greater than about 2mm^2, and, especially, not greater than 1mm^2.

Preferably the diameter of the capillary feed device is in the range 0.1-3mm, most preferably 0.5-2mm. By "diameter" we mean the diameter itself when the capillary feed device is circularly cylindrical (as is preferred), and the maximum diameter, when it is not.

Preferably means for accelerating the delivery of liquid by the capillary feed device comprises means to accelerate the evaporation of liquid from the capillary feed device or from a pad in contact therewith. Preferably said means are arranged to accelerate the evaporation of liquid from the distal end face of the capillary feed device.

The means for accelerating the delivery of the liquid by the capillary feed device could in principle be a fan or other air draught means. Preferably, however, the means for accelerating the delivery of the liquid by the capillary feed device comprises a heater arranged to heat the distal end region and/or a pad in contact therewith. The heater may be a point source heater arranged to heat the distal end face of the capillary feed device, or a pad in contact therewith, and to provide no or only incidental heat to the longitudinal surface of the distal end region of the capillary feed device, or may be a small heater arranged to heat the longitudinal surface of the capillary feed device adjacent to the distal end face, or may be a heater arranged to heat both that longitudinal surface and the distal end face, or a pad in contact therewith. One example of a suitable small or point source heater is a heater which emits heat from a junction between two different metals, by the Peltier effect.

Preferably the means to accelerate the delivery of the liquid of the vapour-release device is powered by an electrical power source. It could be mains electricity, but preferably electricity is supplied by a battery.

Preferably the vapour-release device comprises control means for rendering the release of vapour intermittent and/or for controlling the emission rate, when vapour is being released. The control means may comprise a timer under the control of a user.

A vapour-release device in accordance with the invention may comprise a plurality of stores of liquids to be evaporated, each store being associated with a capillary feed device, to draw liquid from a respective store, wherein each capillary feed device comprises means for accelerating the delivery of the liquid drawn by the respective capillary feed device. Such a vapour-release device comprising at least two stores for liquids may however comprise a single power source and a single control means. The control means preferably enables a user to select which vapour is to be evaporated, and when, and/or to control the rate of evaporation, when vapour is being released.

In accordance with a second aspect of the present invention there is provided a method of delivering a vapour to an air space, the method comprising the use of a vapour-release device of the invention as defined herein.

The invention will now be further described by way of example with reference to the accompanying drawings in which:

Figure 1 represents in schematic sectional view a vapour-release device in accordance with the first aspect of the present invention;

Figure 2 shows a capillary feed device for use in the vapour-release device of Figure 1;

Figures 3 to 12 show alternative capillary feed devices for use in the vapour-release device of Figure 1; and

Figure 13 is a graph showing rates of evaporation of two fragrances emitted by one device.

The vapour-release device shown schematically in Figure 1 comprises a bottle 2 containing liquid 4 to be evaporated (a fragrance in this embodiment) retained within a plastics housing 6. A thin capillary feed device 8 passes through the neck 10 of the bottle, having a proximal end region 12 adjacent to the base 14 of the bottle and a distal end region 16 out of the bottle, adjacent to the top wall 18 of the housing. A point source heater 20 emitting heat by the Peltier effect, is located so as to direct heat only onto the distal end face 22 of the capillary feed device. The point heater source 20 is powered by a small watch or camera battery 24 (although in other embodiments one or more alkaline batteries, for example of AAA size, can be used) and the delivery of power is controlled by a control means 26, for example an Application Specific Integrated Circuit (ASIC), incorporating a timer, whose control buttons can be seen at 28, 30. The top wall 18 is able to open about a weakened rear

edge 32, serving as a hinge to allow the user access to the inside, to change the battery 24 and bottle 2. Adhesive pads 34, 36 are provided on the rear wall 38 of the housing, to facilitate securement of the device to a convenient surface in any convenient place. The upper region of the housing, including the top wall 18, has perforations (not shown) to assist the flow of the vapour into a room space.

The capillary feed device of the Figure 1 embodiment is, an extruded monofilament of a relatively stiff polyacetal material. Figure 2 shows the distal end face 22 of the capillary feed device of the Figure 1 embodiment. It will be seen that the outer surface is circularly cylindrical, with no grooves or surface conformations. The external diameter is approximately 0.6mm. The device has an outer wall 40 of wall thickness approximately 0.13mm and inside that wall 40 there is a linear longitudinal pathway of complex cross section. It is not a purely cylindrical bore. It may be regarded as a cylindrical bore into which extend six multiply-lobed ingresses 44. The ingresses 44 approach each other closely but do not touch each other. Thus the space left between them is a pathway of highly complex cross section, very effective for drawing liquid through it by capillary action.

In an alternative embodiment to that of Figures 1 and 2 the device is the same except that the capillary feed device is a cylindrical body of compressed polyester fibres, 2mm in diameter, as usually used in "felt-tip" pens. The capillary pathways are the complex spaces between fibres.

Figure 3 shows an alternative capillary feed device, which is generally circularly cylindrical, and which has no internal capillary pathway or pathways. However it has a series of external longitudinal capillary pathways 46 in the form of eleven grooves, whose depth is greater than their width, and through which liquid can efficiently drawn by capillary action. The diameter of the longitudinally formed body shown in Figure 3 is 0.6mm. The grooves are approximately 0.15mm deep and approximately 0.04mm wide.

Figure 4 shows an alternative embodiment of capillary feed device which is generally hexagonal in cross section, and has both internal and external capillary flow pathways. In cross section the shape is somewhat like a snowflake. Each external face has a number of parallel grooves which act as external capillary pathways. Between the centre of the capillary feed device and each face is a longitudinal pathway which is generally triangular in cross section. This is not a sealed pathway; there is a small gap by means of which there is communication between each triangular-section pathway and the outside of the capillary feed device. Nevertheless the triangular-section pathways function as internal capillary pathways. The diameter of the longitudinally formed body shown in Figure 4 (by which we mean the maximum diameter from one edge of the longitudinally formed body to the opposite edge) is approximately 1.1mm.

Figure 5 shows an alternative capillary feed device which comprises an effective internal capillary pathway provided between highly lobed ingresses 48. The external surface is generally circularly cylindrical but superimposed on the cylindrical surface is a scalloped pattern and, depending on the liquid to be evaporated, this may perform a capillary function. The diameter of the longitudinally formed body shown in Figure 5 is 1.3mm.

Figures 6-11 show alternative designs of capillary feed devices, which we need not describe individually in writing. The capillary feed device shown in Figure 6 in perspective view, has a diameter of 1.3mm. The capillary feed devices show in Figures 7-10 in sectional view have a diameter of 0.4mm.

A further capillary feed device is shown in Figure 12. This has a surface which is circularly cylindrical, without any surface conformations. It has a very thick wall and very small central capillary pathway of complex shape. The external diameter of the longitudinally formed body shown in Figure 12 is approximately 3mm and the diameter of the central capillary is approximately 0.5mm.

Each of the capillary feed devices shown in Figures 2-12 is formed by extrusion. Each is available from Aubex Corporation of Japan.

A further embodiment of vapour-release device (not shown) is similar to that of Figure 1 but the housing contains two bottles containing different fragrances. Each bottle has its own capillary feed device extending through it and the distal end of each capillary feed device is opposed by a respective point source heater. However, there is only one battery and one control means, again an ASIC circuit, which includes a timer. The control means is able to determine when fragrance is drawn from one bottle on operation of one heater and when the other fragrance is drawn from the other bottle, on operation of the other heater. If wished both fragrances may be emitted at the same time. Figure 13 shows the evaporation rate that is achievable with such a device, with the two fragrances being of similar evaporation characteristics and being emitted alternately.

In these embodiments the liquid being evaporated is a fragrance. In other embodiments it could be a deodoriser, a sanitiser, and insecticide or any other desired heat volatile material. When it is a fragrance being evaporated it could be a floral fragrance or it could be a fragrance evoking a beverage, such as coffee, or evoking a foodstuff, such as bread being baked.

It will be appreciated by using a small, flat battery 14 as used for watches and cameras or by using one or two small alkaline batteries such as size AAA, the device can be made very compact, primarily limited by the size of the bottle, or bottles. However, because a point source heater opposes only the distal end face of a respective capillary feed device, the amount of liquid evaporated can be closely controlled. It may be a very small amount. This means that a concentrated liquid may be used, and so the bottle can be very small. Concentrated fragrances are available to give good fragrancing of an average size room at an emission rate of only 0.3g of fragrance per day. Furthermore, the provision of control means such as 15 renders the operation more efficient still. This is because it may be set to release

vapour only at intervals. If fragrance, for example, is released continuously a process of nasal adaptation takes place. By making the delivery of the vapour intermittent this adaptation may be avoided. Thus, the fragrance may be more readily perceived, and yet be more sparingly dispensed.

Although we have described devices in which evaporation is from the distal end region, in particular the distal end face, of the capillary feed device in other embodiments the capillary feed device delivers liquid to a pad, from which evaporation takes place.

It will be appreciated that devices according to the invention may be made adjustable by control of the amount of heat delivered to the capillary feed device. For example the spacing between the heater and the end face may be altered; the heater may take less power; or a barrier may selectively be placed between the heater and the end face.

CLAIMS

1. A vapour-release device comprising a store of liquid to be evaporated, the store being associated with a capillary feed device having a proximal end region within the store and a distal end region outside the store, the capillary feed device being of minimum cross-sectional area not exceeding $10mm^2$ and being adapted to deliver liquid from the store to the distal end region, and the device comprising means to accelerate the delivery of liquid by the capillary feed device.

2. A vapour-release device as claimed in claim 1, wherein the means to accelerate the delivery of liquid by the capillary feed device comprises a heater located to heat the distal end region of the capillary feed device or to heat a pad in contact therewith.

3. A vapour-release device as claimed in claim 2, wherein said means comprises a point source heater.

4. A vapour-release device as claimed in any preceding claims, wherein the means to accelerate the delivery of liquid by the capillary feed device is powered by an electric battery.

5. A vapour-release device as claimed in any preceding claim, wherein the capillary feed device has one or more linear capillary pathways.

6. A vapour-release device as claimed in claim 5, wherein the capillary feed device has one or more internal linear capillary pathways.

7. A vapour-release device as claimed in claim 5 or 6, wherein the or each linear capillary pathway extends longitudinally along the capillary feed device.

8. A vapour-release device as claimed in claim 7, wherein the capillary feed device is longitudinally formed.

9. A vapour-release device as claimed in claim 8, wherein the capillary feed device is a body of plastics material formed by extrusion.

10. A vapour-release device as claimed in any of claims 1 to 4, wherein the capillary feed device is of consolidated fibre form.

11. A vapour-release device as claimed in any preceding claim, wherein the minimum cross-sectional area of the capillary feed device is in the range 0.1-8mm^2.

12. A vapour-release device as claimed in any preceding claim, the device comprising control means for rendering the release of vapour intermittent and/or for controlling the emission rate, when vapour is being released.

13. A vapour-release device as claimed in claim 12, comprising a plurality of stores of liquids to be evaporated, and a capillary feed device associated with each store, to draw liquid from a respective store, wherein each capillary feed device is associated with means for accelerating the delivery of the liquid by the respective capillary feed device, and wherein the vapour-release device comprises control means for rendering the release of each vapour intermittent and/or for controlling the emission rate of each vapour, when vapour is being released.

14. A vapour-release device as claimed in claim 13, wherein the device has a single power source and a single control means.

15. A method of delivering a vapour to an air space, the method comprising the use of a vapour-release device as claimed in any preceding claim.

16. A vapour-release device or method substantially as hereinbefore described with reference to the accompanying drawings.

Application No: GB 0000124.8 **Examiner:** Gareth Prothero
Claims searched: 1 to 16 **Date of search:** 29 August 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): AG5 GV

Int Cl (Ed.7): A61L 9/02, 9/03, 9/04, 9/12

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2233230 A	(SHIMIZU) see abstract and fig 1.	1, 2, & 5 to 12
Y	GB 2194442 A	(FUMAKILLA) see abstract and fig 1.	1, 2, & 5 to 11
Y	EP 0882459 A1	(BOLOS BRU) see abstract and fig 1.	1, 2, & 5 to 11
Y	WO 97/28830 A1	(STEINEL) see abstract and fig 1.	1, 2, & 5 to 11
Y	US 5810265 A	(JOYCE et al.) see whole document.	1, 2, & 5 to 11
Y	US 5503335 A	(NOAKES et al.) see whole document.	1, 2, & 5 to 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.